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MEMORANDUM FOR : Deputy Director (Research)

SUBJECT : Recommendation for OXCART Camera Procurement

1. This memorandum contains recommendations for approval by Deputy Director (Research) in paragraph 4.

2. The attached Situation Report of OXCART cameras reflects the current status of project camera developments.

3. It is essential that a sufficient inventory of usable cameras be maintained to meet operational commitments while retaining enough flexibility to convert to better, more reliable or higher resolution systems if they become available.

4. Recommendations:

a. Action be initiated to procure glass blanks and other long lead time items for the fifth and sixth Perkin Elmer cameras.

b. Production of the fourth Perkin Elmer camera be authorized, since the glass elements for this camera are already on order.

c. Pacing items for the Type IV Hycon HR 333 camera be procured for three cameras in order that lead times may be reduced in the event that it is found expedient to order three cameras in September 1963.

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Handle via [redacted] Control System

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[redacted]

5. Cost Estimate:

a. Perkin Elmer camera and long lead time items:

	FY 63	FY 64	Total
25X1A Complete Perkin Elmer Camera #4	[redacted]		
Long Lead Items Glass Blanks for Perkin Elmer 25X1A Cameras #5 and #6	[redacted]		

Delivery: The fourth Perkin Elmer camera can be delivered in 10-12 months.
The fifth camera: 12-15 months.
The sixth camera: 13-16 months.

b. Estimate of long lead time pacing items for the Type IV Hycon Camera system:

	FY 63	FY 64
25X1A 3 sets mirrors 3 lens systems	Place order	[redacted]
Total		

The first lenses and mirrors can be delivered within nine months, the balance at a one per month rate.

JACK C. LEDFORD
COLONEL, USAF
Assistant Director
(Special Activities)

Recommendations in paragraph 4 approved:

Signed Herbert Scoville, Jr.
HERBERT SCOVILLE, JR 27 MAY 1963
Deputy Director
(Research)
Att: Situation Report [redacted] 2567-63) 25X1A
Project Status Chart

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MEMORANDUM FOR THE RECORD

SUBJECT : Situation Report - OXCART Cameras

1. The Perkin Elmer so-called Type I camera was initially ordered in a quantity of six; one flyable prototype and five production models. During the course of development of the prototype the efforts of the contractor to get the ultimate resolution from the system led to a degree of complexity that appeared undesirable. Accordingly, a second contract was let to Eastman Kodak for a flying prototype camera, using the philosophy of simple mechanical design, and accommodating the camera to the environment rather than changing the environment to suit the camera, as Perkin Elmer had done. At the same time a modification of the "B" camera was supported as a backup system to insure that one of the three types would be available for use in the OXCART vehicle. All three systems have met their design goals insofar as it has been possible to test them without having a vehicle that would provide the "high, hot and fast" environment for which they were designed. At present there are three Perkin Elmer cameras, three Eastman cameras, and one [redacted] "B" camera modified in various stages of delivery and flight test (see Tab 1). In February 1963, a contract was let to Hycon Manufacturing Company for three cameras of a design similar to the "B" cameras that are being used successfully in the IDEALIST program. This camera is of a proven design and promises a ground resolution equal to that of the Perkin Elmer system.

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2. Following is a brief analysis of each system:

a. Perkin Elmer Type I Camera

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(1) This camera employs an [redacted] focal length [redacted] catadioptic lens with a four sided scanning mirror to sweep the image on to the film. [redacted] of thin base SO-132 film is used to cover an area of [redacted] square miles. This system has been flight tested twice in a C-123 and 19 times in the OXCART with no malfunctions that precluded successful photography. Measurements of ground, resolving

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power targets have been made at [redacted] lines per millimeter, which, at the [redacted] altitude that they were using, is better than [redacted] ground resolution. The ave[redacted] ments is about [redacted] ground resolu[redacted] be qualified f[redacted]

(a) The [redacted] increase in ground reso[redacted] simp[redacted] due to being [redacted] closer to the target than operational altitude.

(b) The vehicle rate was less than half of design rate which would add resolution degradations of unknown magnitude du[redacted] to thermal gradients across the photographic windows and possible boundary layer turbulance.

(c) The helium environment in the camera bay was not in for these tests nor was the hard vacuum window in. This might tend to degrade the resolution slightly.

(d) Seeing conditions at [redacted] altitude are generally poorer than they are at higher altitudes.

(2) The Type I camera employs an optical system that delivers the same resolution across the full format that it does at the optical axis, a distinct advantage since much of the photography of interest may be [redacted] miles slant range from the vehicle and [redacted] degrees off axis of the lens.

(3) Some concern has been felt about the field maintenance, reliability and general mechanical complexity of this system for operational use, however flight tests to date have revealed no cause for alarm. At the same time, a choice between two systems of equal intelligence gathering ability would invariably favor the simpler system.

b. Eastman Type II Camera

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(1) This camera employs a [redacted] refractor lens of [redacted] lines/mm resolution at low contrast on axis that should give [redacted] ground resolution at altitude. Two rolls of SO-132 film, each [redacted] in length, give a range of [redacted] nautical miles and a coverage laterally of [redacted] nautical miles from [redacted] altitude. Since the system actually consists of two separate panoramic cameras giving convergent and redundant overlapping stereo coverage, an advantage is gained in examining areas that may be partially obscured with cloud cover.

(2) Mechanical simplicity and maintenance free design is a characteristic of the system; however, it will not provide as good ground resolution as the Perkin Elmer system. This shortcoming is partially overcome by a slightly longer focal length (larger scale) and in some respects better stereo coverage. Here, again, it is difficult to assess the ultimate capability of the system, since the environment in which it will be used operationally is not yet available for a dynamic test.

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c. [redacted] Type III Camera

(1) This is a "B" camera that has been modified to operate in the OXCART environment. Flight tests show that the modifications were successful and that satisfactory performance can be expected in the OXCART, however, it was never intended that an improved ground resolution might be achieved.

d. Hycon Type IV Camera

(1) This camera, in design and concept, follows the pattern of the "B" camera used in IDEALIST. It takes advantage of recent development in film transport, optical technology and vibration control. A [redacted] lens is employed to cover an [redacted] format at a ground resolution of better than [redacted] A seven position mode consisting of 3 right obliques, a vertical, and 3 left obliques provide [redacted] nautical miles of line coverage and a swath width of [redacted] nautical miles. The contract has

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been let to Hycon for three of these cameras, the first to be delivered for flight test in September 1963. Although this is a new and untried system, the major components have been built and tested on previous programs. Further, the basic concept is the same as the "B" camera that the contractor has had many years of experience with.

(2) The contractor's knowledge of and experience with the environmental problems of high speed aircraft is limited to a series of aerial photographic flight tests conducted in the X-15. These tests are considered atypical, since the X-15 could not maintain a speed and altitude comparable to the OXCART for a long enough time for thermal and aerodynamic stability. The camera used in the X-15 tests was not a high resolution nor long focal length system and the temperatures inside the bay were varying considerably.

3. a. In summary then, the Type I camera has so far delivered the best resolution in flight test and has shown a reliability during 19 flight tests beyond what one would have expected from a design of this complexity.

b. The Type II camera has demonstrated its reliability, but has had a lower ground resolution than the Type I.

c. The Type III camera is considered only as a back-up system.

d. Type IV appears to have a great potential for a high resolution system, but to date has not been demonstrated and will not be until September 1963.

e. Earliest high and hot test flights with camera packages will probably be July 1963. Allowing a month for test and evaluation of the Type I and Type II cameras, a decision might be made in August regarding additional camera procurements. Our OXCART camera assets at that time will be three Type I cameras and three Type II cameras providing no additional procurements or attritions occur in the interim. A minimum

of ten months lead time is required for the production of additional cameras of either type. The initial lead time items are lenses, mirrors, and windows that are ordered from overseas sources and require four to five months for the delivery of the optical blanks of prescribed glass from which the elements are ground and polished.

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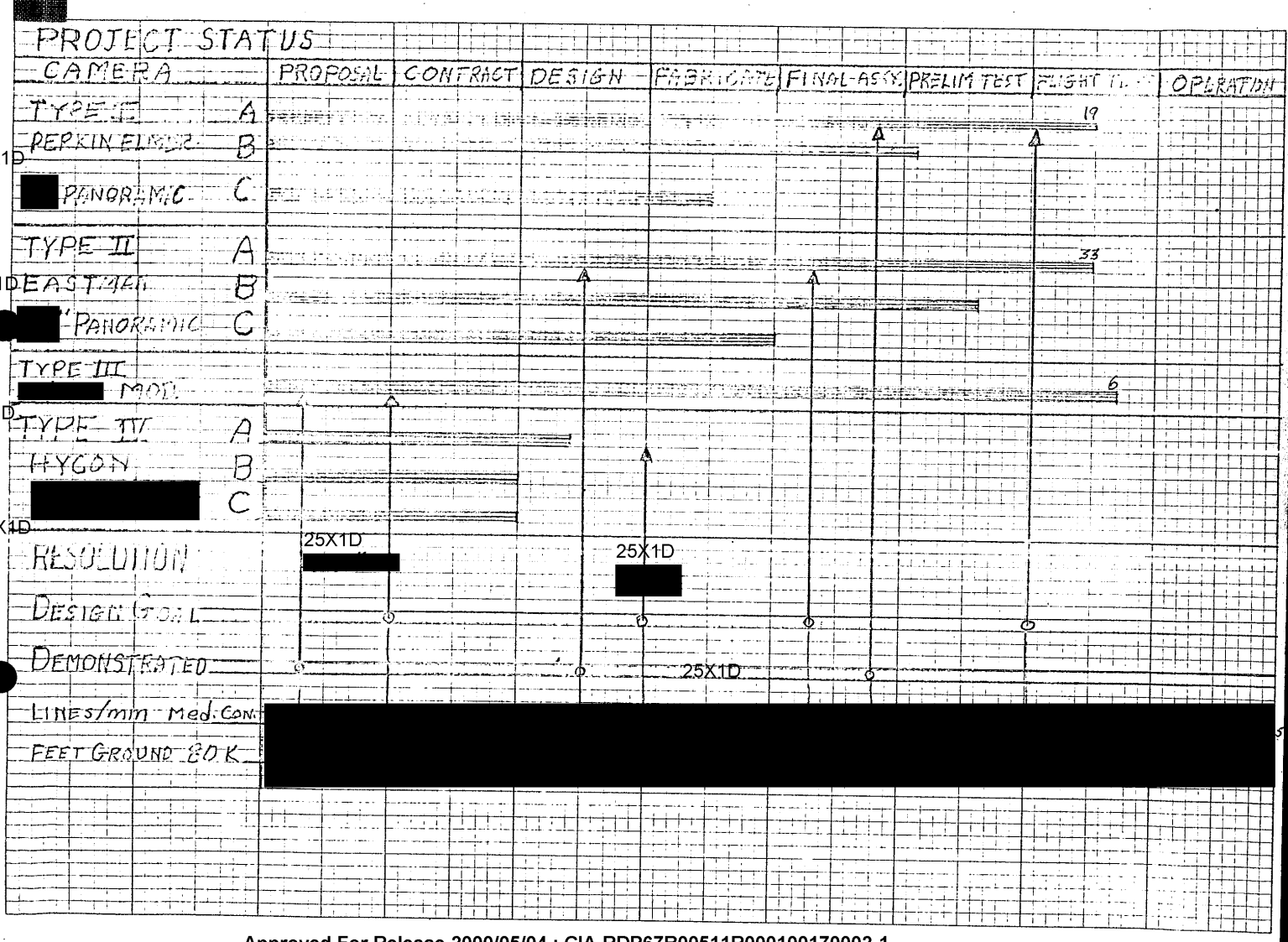
[redacted]
Development Division
(Special Activities)



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This document contains information referring to Projects:

OXCART ....

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